COURSE TITLE	**DATA STRUCTURE**
COURSE CODE	**01AI0304**
COURSE CREDITS	**4**

Objective:

1 To understand different data structures and algorithms.
To solve problems using data structures such as linear lists, stacks, queues, binary trees, and graphs and writing programs for these solutions.
To efficiently implement the different data structures and solutions for specific problems.

2 To understand different data structures and algorithms

Course Outcomes: After completion of this course, student will be able to:

1 To learn the different types of data structures, operations on them and applications (Understand)

2 To choose the appropriate data structure and algorithm for a specified application. (Apply)

3 To analyse various sorting and searching techniques with applications. (Analyse)

4 To implement linear data structure such as stacks, queues, linked lists and their applications (Create)

5 To implement non-linear data structure such as trees, graphs and their applications (Create)

Pre-requisite of course: Computer Programming in C

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	**Introduction** Introduction to data type and data structure, Types of data structure: primitive & non-primitive, linear & non-linear. Operations on data structures: traversing, searching, inserting, deleting e.t.c. Algorithms, Complexity analysis – worst case, best case, average case.	3
2	**Arrays** Introduction to Arrays, Array Representation: Row major order & Column major order, One dimensional and 2D array, Storage structure of arrays, operations on arrays, Sparse Matrix	4
3	**Sorting and Searching** Introduction, Classification of Sorting, Types: Bubble sort, Selection sort, Insertion sort, Quick Sort, Merge Sort, Radix sort., Searching: Linear or sequential search, Binary search	6

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Contents : Unit	Topics	Contact Hours
4	**Stack, Queue and Linked List** Introduction to Stack and implementation, Operations on stacks, Polish Expressions and their compilation, Application of stack, Tower of Hanoi, Recursion, Queue: Introduction to Queue and implementation, operations on Queue (insert, delete), Circular Queue, Double Ended Queue, Priority Queues, Applications of Queue, Linked List: Introduction, Implementation of Linked List, Singly Linked List, Doubly Linked List, Circular Linked List, Circular Doubly Linked, and Applications of Linked List.	15
5	**Tree and Graphs:** Tree: Terminologies, Types of tree, Binary Tree Traversal Techniques (Inorder, preorder, postorder)., Binary Search Tree: Definition, Operations, AVL Tree: Definition, Insertion, Deletion, Rotations, Special trees: construction of B Tree and B+ Tree , Graph: Terminologies, Representation of graphs Types of Graph, Graph Traversal Techniques: BFS & DFS, Application of Trees and Graphs	12
6	**Hashing** Concepts and Hash Function, Hashing Methods, Collision, Collision Resolution Technique (CRT), Perfect Hashing	2
Total Hours		**42**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Practical 1** Write a program that implement array operations a) Insertion b) Deletion c) Traversal	2
2	**Practical 2** Write a program that implements the following sorting a) Bubble sort b) Insertion sort c) Selection sort	2
3	**Practical 3** Write a program that implements the following a) Quick Sort b) Merge sort	2
4	**Practical 4** Write a program for searching an element from the given list a) Linear search b) Binary search.	2
5	**Practical 5** Write a program to implement STACK using array that performs following operations: (a) PUSH (b) POP (c) Display (d) isEmpty (e) isFull	2
6	**Practical 6** Write a program to implement Queue using arrays that perform the following operations. (a) Insert (b) Delete (c) Display (d) isEmpty (e) isFull	2

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Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
7	**Practical 7** Write a program to implement Circular Queue using arrays that perform the following operations. (a) INSERT (b) DELETE (c) DISPLAY (d) isEmpty (e) isFull	2
8	**Practical 8** Implement a program to convert infix notation to postfix notation using stack	2
9	**Practical 9** Write a program that uses functions to perform the following operations on singly linked list i) Creation ii) Insertion & Deletion at the beginning, at the end and at the specific position iii) Traversal	2
10	**Practical 10** Write a program that uses functions to perform the following operations on Circular linked list i) Creation ii) Insertion & Deletion at the beginning, at the end and at the specific position iii) Traversal	2
11	**Practical 11** Write a program that uses functions to perform the following operations on Circular doubly linked list i) Creation ii) Insertion & Deletion at the beginning, at the end and at the specific position iii) Traversal	2
12	**Practical 12** Write a program to perform the following operations: a) Traversing all the elements of a binary search tree. b) Search for a key element in a binary search tree.	2
Total Hours		**24**

Textbook :

1 Data Structures using C & C++, Tanenbaum, PHI, 2012

References:

1 Tanenbaum, Data Structures using C & C++, , Tanenbaum, Data Structures using C & C++, , PHI, -, -

2 Data Structures and Program Design in C, Data Structures and Program Design in C, Robert L. Kruse, PHI, -

3 Data Structures using C, Data Structures using C, E Balagurusamy, TMH, -

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery

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Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
15.00	15.00	20.00	20.00	20.00	10.00

Instructional Method:

1. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc
2. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
3. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory
4. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

Supplementary Resources:

1. https://visualgo.net/en
2. https://www.cs.usfca.edu/~galles/visualization/Algorithms.html
3. https://quizlet.com

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